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GB 2185098 A WO 86/07130 A AU 008313675 A
US 4413615 A

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(54) Solar heating installation

(57) The panel 1 feeds a heat exchanger in a storage tank by a thermosyphon system and may be arranged to track the sun under computer control by rotation about vertical and horizontal axes. It may be inclined and be surrounded by a wind shield 4. The panel preferably includes an energy-absorbing layer, e.g. of double or triple walled polycarbonate, which is located above a fluid path. The layer or the fluid may be darkly coloured, and the fluid be located above a light reflective, heat insulating layer. The energy-absorbing layer is secured to a base by reception in an inwardly directed recess or by clips. The base may also be of brick or concrete and ground mounted.

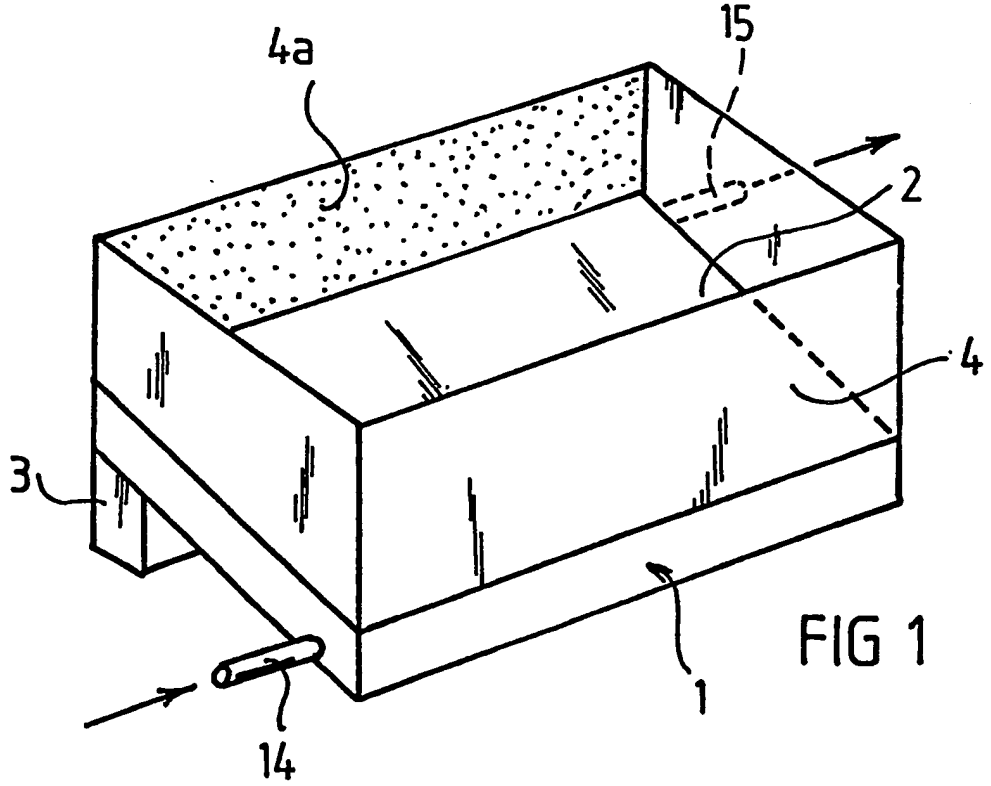

FIG 1

At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

GB 2 259 979 A

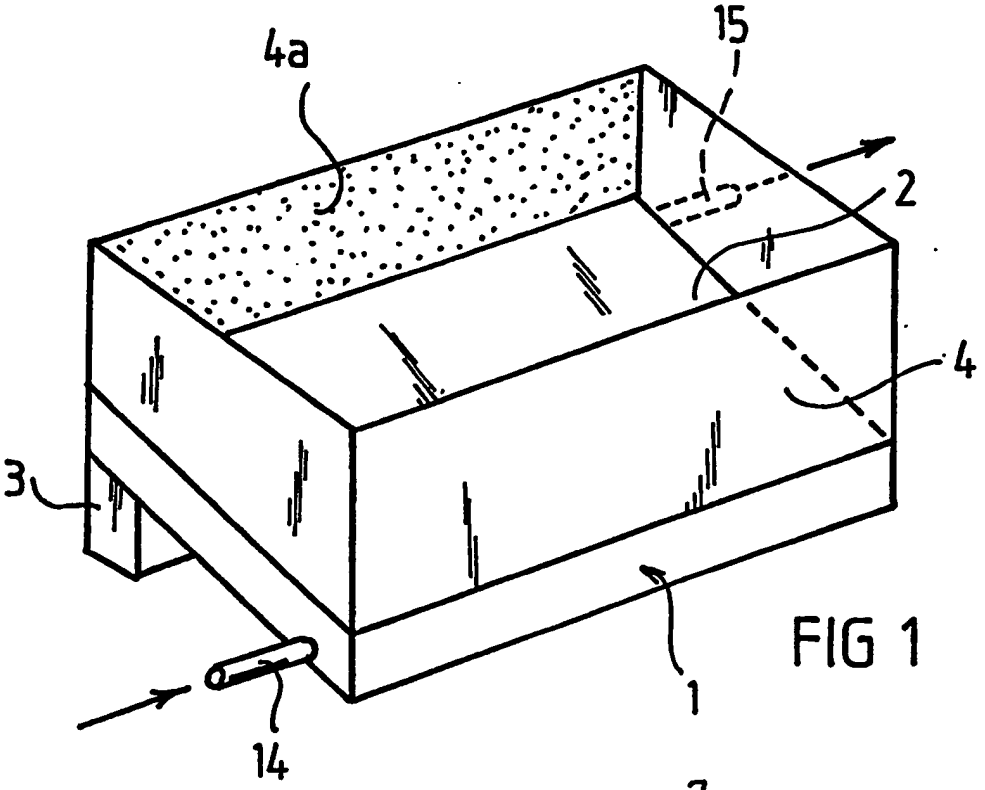

FIG 1

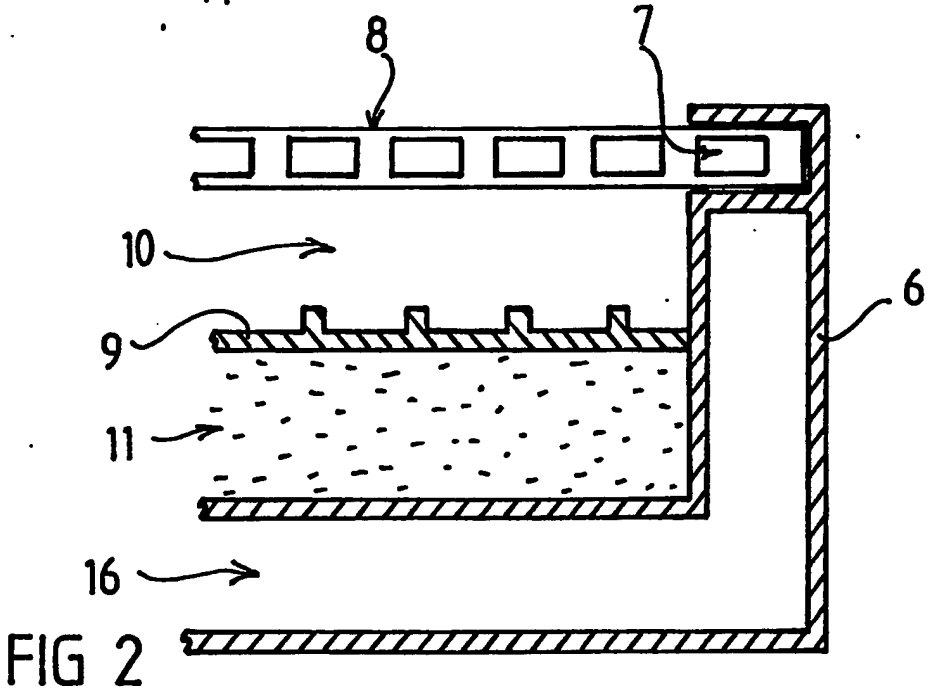

FIG 2

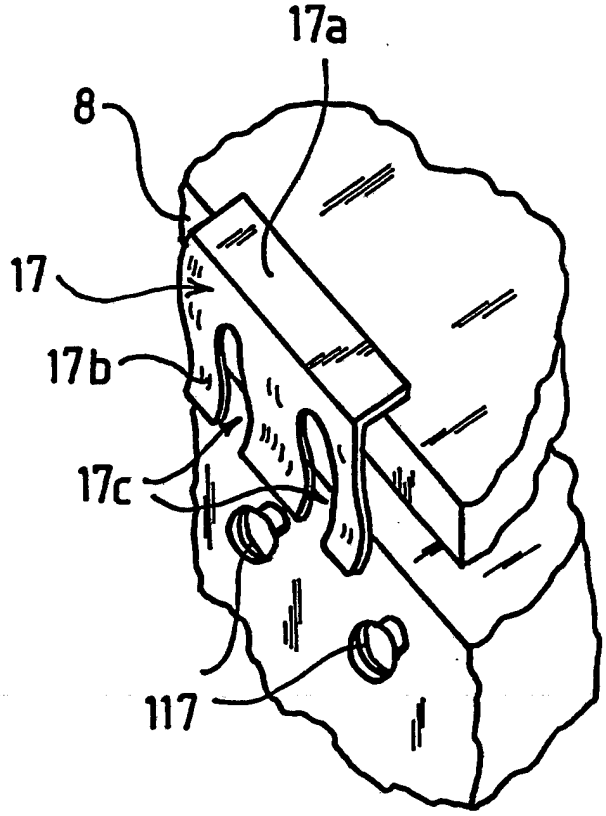

FIG 3

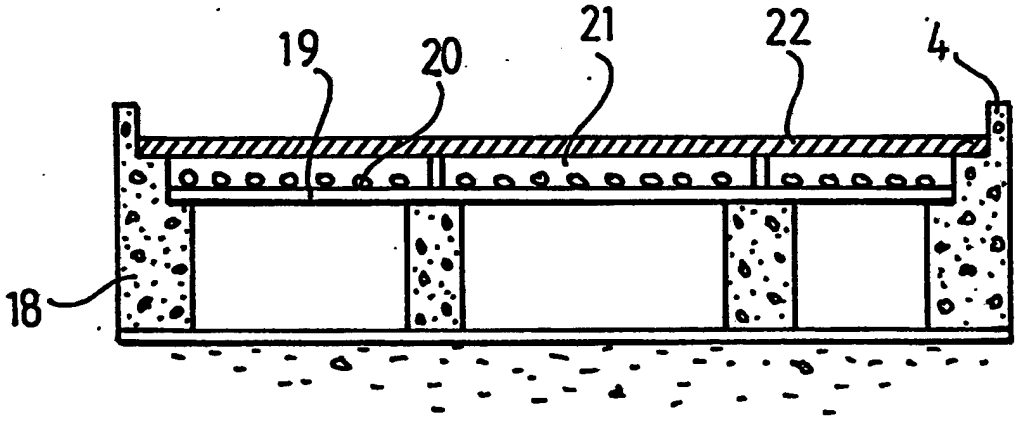

FIG 4

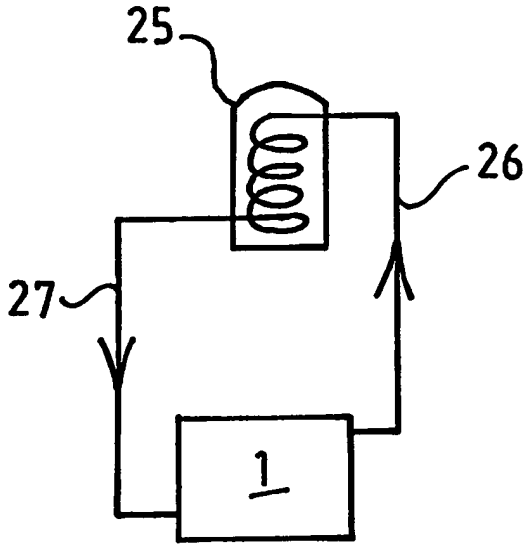

FIG 5

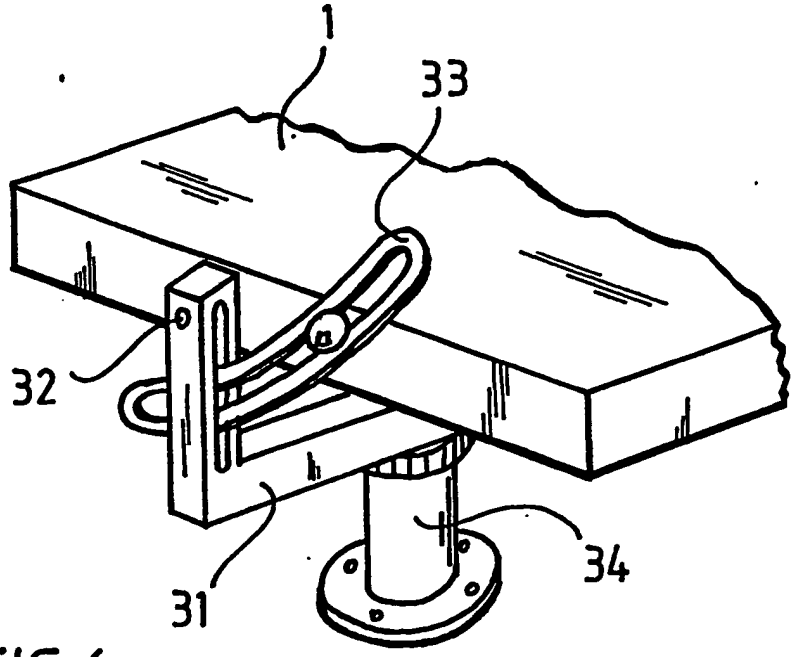

FIG 6

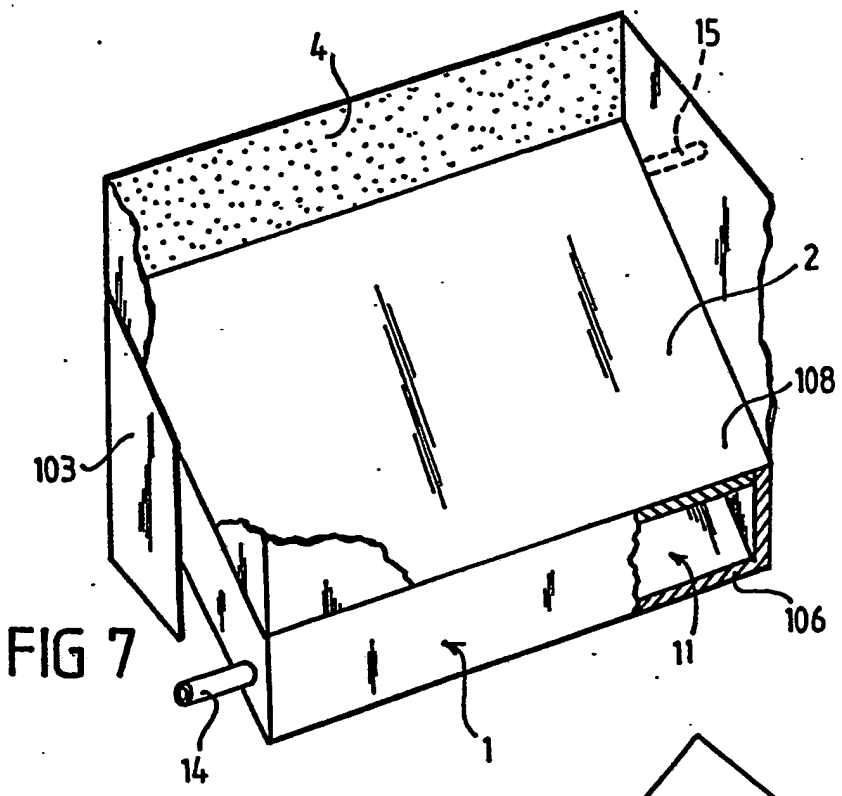

FIG 7

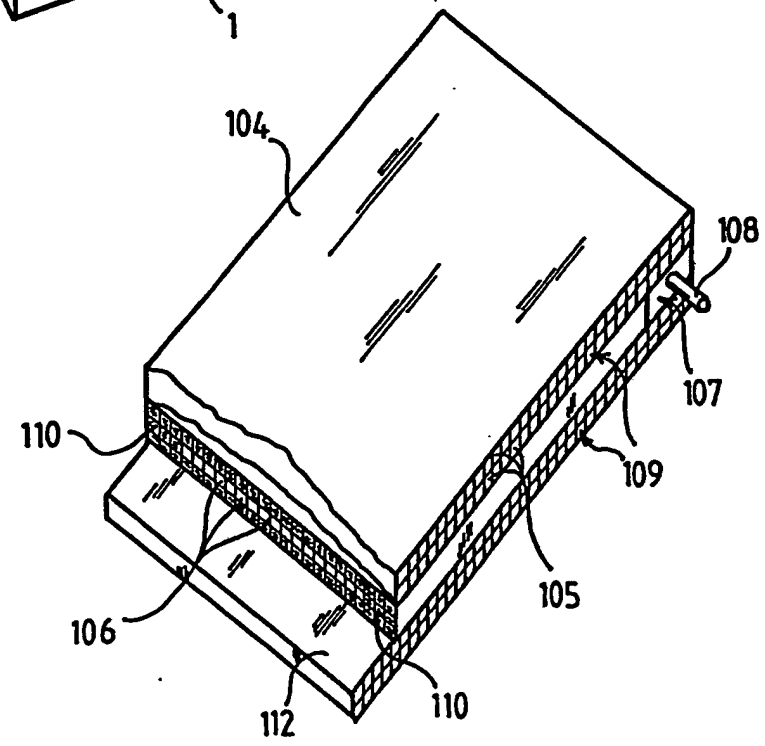

FIG 8

SOLAR PANELS

TECHNICAL FIELD OF THE INVENTION

This invention relates to solar heating panels in which the energy of the sun is used to heat a fluid, usually (but not exclusively) water.

SUMMARY OF THE INVENTION

According to a first aspect, the present invention proposes a solar heating system comprising a solar heating panel and a heat exchanger, arranged such that heating fluid circulates between the panel and the heat exchanger by a thermosyphon effect.

The heat exchanger will usually comprise a conduit passing through a storage tank.

According to a second aspect the invention also proposes a solar heating panel having a receiving surface for solar energy and containing a flow path for water or other heat-absorbing fluid medium, in which the said receiving surface is provided by a solar energy receiving sheet received in an inwardly directed recess formed in a moulded frame.

According to a third aspect the invention proposes a solar heating panel having a receiving surface for solar energy and containing a flow path for water or

other heat-absorbing fluid medium, in which the said receiving surface is supported by a base formed of concrete, brick and concrete or the like.

According to a fourth aspect the invention proposes a solar heating panel having a receiving surface for solar energy and containing a flow path for water or other heat-absorbing fluid medium, in which the said medium incorporates a pigment.

According to a fifth aspect the invention proposes a solar heating panel having a receiving surface for solar energy and containing a flow path for water or other heat-absorbing fluid medium, in which the said receiving surface is provided by a panel which comprises at least two walls separated by an enclosed gap.

The said panel may conveniently comprise a sealed double or triple glazing unit or a double or triple walled plastics sheet including a plurality of parallel spaces.

According to a sixth aspect the invention proposes a solar heating panel having a receiving surface for solar energy and containing a flow path for water or other heat-absorbing fluid medium, in combination with upstanding wind shield means which at least partially surrounds the said receiving surface.

It has been found that the incorporation of a wind shield substantially improves the efficiency of the panel.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention is exemplified in the accompanying drawings, in which:

Figure 1 is a general perspective view of one form of solar panel of the invention,

Figure 2 is a section through an edge region of the panel,

Figure 3 is a perspective view of a clip for use in the panel,

Figure 4 is a sectional view of another form of the panel,

Figure 5 is a general view of a water heating system incorporating the panel,

Figure 6 is a perspective view of a mounting for the panel,

Figure 7 is a general perspective view of a second form of solar panel of the invention, shown partially cut-away for convenience of illustration, and

Figure 8 is a general perspective view of an alternative form of the solar panel.

DETAILED DESCRIPTION OF THE DRAWINGS

Referring to Fig. 1, a generally rectangular solar panel 1 includes an upper heat and light receiving surface 2 which is tilted towards the sun by a support 3 extending below the rear edge of the panel 1. The panel is surrounded on all four sides by an upstanding wall 4 which acts as a wind shield. The wall 4 is of transparent plastics material (more important for winter use) except for the portion 4a which extends along the rear edge of the panel, which is darkly coloured, e.g. matt black. This portion 4a may be of other colours and could, for example, be mirrored or white to reflect light towards the upper surface 2 of the panel.

With the panels of the invention the upper edge of the wind shield is preferably generally horizontal despite the fact that the panel is tilted, i.e. the front section of the wall 4 is taller than the rear.

As shown in Fig. 2, the panel 1 comprises a double-walled plastics or glass fibre housing 6. (The housing 6 may also be single walled and formed of a heat-insulating material such as expanded polystyrene.) The illustrated housing 6 includes an inwardly directed groove 7 running around its inner upper edge to receive a light-transmitting sheet 8. This sheet 8 may be formed of a single layer but is preferably formed of double (or triple) walled material such as a sealed glazing unit in which two or more sheets of glass are held apart by a spacer bar which is sealed to the sheets around their periphery. In the illustrated example however, the sheet 8 is a polycarbonate sheet in which the two (or three) walls are separated by a series of enclosed parallel air gaps. A partition wall

9 is located below the sheet 8 to form an insulating air gap 10 between the wall 9 and sheet 8. The partition wall 9 may be of relatively thin-walled metal or plastics for example and may be light-transmitting or darkly coloured, e.g. matt black, and may optionally be finned or ribbed on its upper surface for improved heat absorption. A water chamber 11 is formed between the partition wall 9 and the base of the housing 6. Water enters the chamber 11 via an inlet pipe 14 (Fig. 1) adjacent to the lower front edge of the panel and leaves via an outlet pipe 15 adjacent to the upper rear edge of the panel. The space 16 between the two walls of the housing 6 forms a heat insulating layer and may be air-filled or filled with a solid insulation material such as expanded polystyrene.

In general, the internal upper surface immediately below the water layer may be light coloured or reflective or dark to absorb heat and radiate/conduct/convect it back into the fluid to reduce heat loss. The efficiency of the panel is also greatly improved by the addition of a dark pigment to the water, or alternatively, by darkening the light-collecting sheet above the water layer.

Instead of being located in grooves in the housing 6 the top sheet 8 could be secured on top of the housing, optionally bedded on a sealing bead, by means of clips 17, as shown in Fig. 3. The clips are L-shaped and include a top wall 17a which abuts the top face of the sheet 8, and a side wall 17b which abuts the side face of the housing. The side wall 17b contains vertical slots 17c to receive fixing screws 117 so that the clips can be pressed downwardly to urge the sheet 8

against the housing before tightening the screws to secure the clips in position. Such an arrangement enables the amount of pressure exerted on the sheet 8 to be closely controlled so that sufficient pressure can be applied without risk of damaging the sheet. It will be appreciated that bolts can be used instead of the screws 117. The screws could also be replaced by fixed threaded studs which carry wing nuts or the like for clamping the clips 17 against the housing 6.

Fig. 4 shows an alternative form of the panel 1 in which a brick or concrete base 18 supports a board 19 to which a length of tubing 20 is secured in a serpentine configuration, and which is shown in cross section in Fig. 4. A heat-insulating air space 21 is formed above the board 19 by a light transmitting sheet 22 similar to the sheet 8 which is described above. The board 19 may be of a heat insulating material, or alternatively, a layer of heat insulation material (not shown) may be incorporated below the board 19, below a heat mirror. Board 19 may be double skinned.

The panel of Fig. 4 may be mounted on a roof, but will often be mounted at ground level.

The panel of the invention may be connected to a heat-exchange coil located in a water storage tank 25 (Fig. 5) by feed and return pipes 26 and 27. The tank 25 is located at a higher level than the panel 1 (which may be ground or roof mounted) and flow pipe 26 connects the outlet 15 at the top end of the panel to the top of the heat exchange coil. Pipe 27 returns the cooler fluid from the bottom of the coil to the lower inlet 14 of the panel 1. With such an arrangement the water

circulates via the tank and panel by a simple thermosyphon action so that no thermostats, pumps, heat sensors, valves or similar control devices are required. (A pump may of course be incorporated if required.)

A number of panels of the invention could be arranged in an arcuate configuration so that at least one of the panels will always be angled towards the sun during the course of a day. Such a configuration has itself been found to provide an improved degree of shielding from the wind, resulting in improved efficiency. Alternatively, this or each panel can be mounted such that it can be moved to track the sun. In this case flexible piping is used for the feed and return connections. The panel could be moved manually but is preferably moved by a motor, rams or other mechanical devices under automatic control. Such control could be achieved using information derived from light-sensitive receptors which are arranged to detect the current position of the sun. Alternatively, or in addition, movements of the panel could be controlled by a computer which is programmed to adjust the orientation of the panel according to the time of day. With such a system daily corrections can easily be applied throughout the year to allow for seasonal variations in the relative position of the sun. The inclination of the panel is preferably also adjustable under control of the computer so that the inclination can be adjusted throughout the day as the angle of the sun changes, being steeper in the morning and evening than at midday.

The necessary movements of the panel could be achieved

in various ways. By way of example, one possible way of moving the panel is shown in Fig. 6, in which the wind shield has been omitted for clarity. The panel is tiltably mounted on a U-frame 31 by pivots 32, the panel being guided during such tilting movement by slotted arcuate guides 33. The U-frame 31 is itself mounted for rotation about the axis of a vertical support post 34. Thus, movement about the vertical axis provides for east-west tracking of the sun whereas movement about the horizontal pivot axis provides for up-and-down tracking.

Fig. 7 shows a modified form of the panel shown in Fig.s 1 and 2. The panel 1 again has an upper heat and light receiving surface 2 which is tilted towards the sun by legs 103. The panel is surrounded on all four sides by an upstanding wall 4 (shown partially cut-away) which acts as a wind shield. The panel 1 includes a single-walled housing 106 formed of a heat-insulating material and which may be light reflective on its internal surface to aid light absorption or dark to absorb heat and radiate/conduct/convect it back into the fluid. The top of the housing 106 is closed by a light-transmitting sheet 108 which again may be single, double or triple-walled. The sheet 108 may be of glass or plastics and may be clear or pigmented and/or coloured on its internal and/or external surface to aid light absorption. The housing thus defines a water chamber 11 which is served by an inlet pipe 14 and an outlet pipe 15. Again, the efficiency of the panel is greatly improved by the addition of a dark pigment to the water, particularly if the sheet 108 is clear.

In place of the clips 17 shown in Fig. 3, the top sheet

8 could be secured by side cheeks which are attached to the sides of the housing 6 by screws or other means and which have lips which overlie the side edges of the top sheet 8.

Fig. 8 shows an alternative kind of panel which could be used with the wind shields and supports described above. The panel includes a series of spaced parallel walls 104, and the space between each pair of walls is divided into longitudinal channels by intervening parallel dividing walls 105. The innermost channels 106 communicate at each end with a respective heat-insulated manifold (only one of which is shown, 107), one of the manifolds being provided with a respective inlet connection 108 and the other being provided with an outlet connection.

The channels 109 between the outermost walls 104 preferably run transverse to the inner water-conducting channels 106 as shown, for better and more even heat retention. The insulating channels 109 are sealed at each end to provide a heat-insulating layer above and below the water-conducting channels 106, and they may be air filled or filled with a solid heat-insulation material. The outermost channels 110 in the same layer or layers as the water-conducting channels 106 are similarly sealed for heat insulation purposes.

There could of course be any number of water-conducting and heat-insulating layers. The walls 104 and 105 may be formed of a plastics material such as polycarbonate for example. The material may be clear or light-coloured, in which case the water or other heat-collecting fluid used is preferably darkly coloured for

maximum heat collection. Alternatively, the walls may be of darkly coloured material with clear or dark-coloured fluid. The top surface 112 of wall 104 forming the upper wall of the bottom heat-insulating layer is preferably mirrored to relect heat and light back into the water layer.

A similar configuration of water channels to that achieved in Fig. 8 could also be achieved in Fig. 4 by replacing the serpentine tube with a number of parallel-connected tubes arranged side-by-side. At one of their ends, all the tubes are connected together by T-joints, or in any other convenient manner, and taken to a water inlet connection. At their other ends the tubes are similarly connected to a common outlet connection. To increase the length of the individual tubes and thereby improve heat absorption they may be secured to the board in a non-linear configuration.

In each of the panels described above the light-receiving surface 2 could be provided by a material which allows light to enter the panel but which reduces the amount of light able to pass through it in the opposite direction. In addition, the upper surface of the heat-insulating layer immediately below the fluid layer may, in each case, be heat and light reflective, e.g. of mirror glass. Where tanks are formed below the water layer the side walls too may be reflective.

* * * * * * * *

CLAIMS

1. A solar heating installation comprising a solar heating panel and a heat exchanger, arranged such that heating fluid circulates between the panel and the heat exchanger by a thermosyphon action.

2. An installation according to Claim 1, in which the heat exchanger is located at a higher level than the solar panel.

3. An installation according to Claim 2, in which the solar panel is inclined and the arrangement is such that a fluid outlet at the upper region of the panel is connected to the upper end of the tank conduit and the lower end of the tank conduit is returned to a fluid inlet at the lower end of the panel.

4. An installation according to any preceding claim, in which the panel includes a solar energy receiving layer located above a fluid path.

5. An installation according to Claim 4, in which the solar energy receiving layer comprises two or more sheets separated by an air gap.

6. An installation according to Claim 5, in which the air gap is divided into a plurality of parallel spaces.

7. An installation according to any one of Claims 4, 5 or 6, in which the solar energy receiving

layer has better light transmission properties from the exterior of the panel towards the fluid path than in the opposite direction.

8. An installation according to any of Claims 4 to 7, in which the solar energy receiving layer is received in an inwardly directed recess formed in a moulded frame.

9. An installation according to Claim 8, in which the solar energy receiving layer is secured to a base structure by clips which are slotted to permit their height adjustment.

10. An installation according to any of Claims 4 to 9, in which the solar energy receiving layer is darkly coloured.

11. An installation according to any of Claims 1 to 9, in which the fluid is darkly coloured.

12. An installation according to any preceding claim, in which there is a light and heat reflective surface below the fluid path.

13. An installation according to any preceding claim, in which there is a heat-insulating layer below the fluid path.

14. An installation according to any preceding claim, in which the said panel is supported by a base formed of concrete, brick and concrete or the like.

15. An installation according to any preceding

claim, in which the panel is provided with upstanding wind shield means which extends around at least part of the panel.

16. An installation according to Claim 15, in which the panel is upwardly inclined in a rearward direction and the upper periphery of the wind shield means lies on a substantially horizontal plane.

17. An installation according to any preceding claim, in which the panel is upwardly inclined in a rearward direction and the rear portion of the wind shield means is darkly coloured.

18. An installation according to Claim 15, 16 or 17, in which the wind shield means is at least partially light-transmitting.

19. An installation according to any preceding claim, in which the panel is mounted for movement about a substantially vertical axis for tracking the sun.

20. An installation according to any preceding claim, in which the panel is mounted for movement about a substantially horizontal axis for tracking the sun.

21. An installation according to Claim 19 or 20, in which the panel is arranged to track the sun under the control of solar position sensor means.

22. An installation according to Claim 19, 20 or 21, in which the panel is arranged to track the sun under computer control.

23. A solar heating installation substantially as described with reference to the drawings.

* * * * * * * *

Patents Act 1977
Examiner's report to the Comptroller under Section 17 (The Search Report)

Application number
GB 9220299.3

Relevant Technical fields

(i) UK Cl (Edition K) F4U (U6244) F4G (G2A1A G2A1B, G9RB)

(ii) Int Cl (Edition 5) F24J 2/44

Search Examiner

ALEXANDER G SMITH

Databases (see over)

(i) UK Patent Office

(ii) ONLINE DATABASE(S): WPI

Date of Search

27 NOVEMBER 1992

Documents considered relevant following a search in respect of claims 1 TO 23

Category (see over)	Identity of document and relevant passages	Relevant to claim(s)
X	GB 2185098 A (BARNARD)	1,2,14
X	WO 86/07130 (LARKIN)	1,3,4,10, 12,13,14
X	US 4413615 (SIGWORTH)	1,2,3
X	AU 8313675 (HART AND CO PTY)	1,2

Category	Identity of document and relevant passages	Relevant to claim(s.

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APPL-NO: GB09220299

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EUR-CL (EPC): F24J002/24 ; F24J002/44, F24J002/46 , F24J002/46 , F24J002/54

ABSTRACT:

CHG DATE=19990617 STATUS=O> The panel 1 feeds a heat exchanger in a storage
tank by a thermosyphon system and may be arranged to track the sun under computer control by rotation about vertical and horizontal axes. It may be inclined and be surrounded by a wind shield 4. The panel preferably includes an energy-absorbing layer, e.g. of double or triple walled polycarbonate, which is located above a fluid path. The layer or the fluid may be darkly coloured, and the fluid be located above a light reflective, heat insulating layer. The

energy-absorbing layer is secured to a base by reception in an inwardly directed recess or by clips. The base may also be of brick or concrete and ground mounted. <IMAGE>